WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003KS31B

Title: Reduced Irrigation Allocations in Kansas from Grain Yield -- ET Relationships and Decision Support Model

Project Type: Research

Focus Categories: Irrigation, Water Use

Keywords: limited irrigation, water allocation, decision support

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Federal Funds: $13,450

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Congressional District: 2nd District

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Abstract

Many irrigators in Kansas are facing immediate challenges due to declining water yields from their wells. Estimates have been made that 30-50 % of irrigation wells in western Kansas are pumping below original capacity. Irrigators in Kansas also face the possibility of shrinking water allocations with changes in water policy or enforcement of current water policy. Any of these scenarios will mean more limited irrigation than has been used in the past.

To make these reductions in water use, irrigators will need to consider shifts in cropping patterns. Irrigators who have shrinking water supplies need to know what cropping combinations to select and in what proportions for best water use and profitability. Every combination of every cropping pattern that an irrigator dreams up can be examined

experimentally with research. An agronomic/economic model is needed to predict results for an individual irrigator's situation.

The main objective of this project is to develop a computerized tool for making decisions on allocating limited water to crops based on scientifically developed crop responses to water and formalized budgeting techniques. This takes the combined efforts and expertise of scientists from the irrigated production view point along with economist's crop budgeting information. Mathematical solutions have been proposed for these types of problems in the past. The limitations of these solutions have hampered approaches to the complex nature of the water allocations not only because of multiple land selections, but also because of multiple land allocations possible among those choices. In this project, an iterative solution was chosen for the model on the basis of more computing power currently in the hands of potential users.

This project was designed to build from the Kansas Water Budget and the crop budgeting process. The Kansas Water Budget provided the framework to predict crop grain yields from evapotranspiration (ET) which was converted into a diminishing return of irrigation response. The yield-irrigation relationships directly feed into the income side of the net return equation and the crop production budgets provide the cost side of the net returns. The net returns of each cropping/land option are ordered for the optimization of the chosen scenario. The water budget was used to simulate annual rainfall from 280 to 530 mm, or the equivalent to the western 1/3 of Kansas.

The next major objective of the project is to anticipate the future for the water allocation model. Currently the Kansas water budget is based on research from traditional farming practices. No-till management with practices to keep crop residue on the ground surface has the potential for influencing the yield-ET and yield-irrigation relationships. Evaporation suppression by the crop residues can shift these relationships because consumptive use changes. As irrigators adopt residue management, these new relationships will be necessary for a new version of the Crop Water Allocator (CWA) tailored to no-till techniques. Therefore, field research to gather data on the yield-ET and yield-irrigation relationships is critical for corn, soybean, wheat, sorghum and sunflower grown in no-till management.